One of the most striking points in his career is that in these years, devoted to the organization of a new institute, he accomplished some of his best scientific work. He made an exhaustive study of the causes of monsters. To this study he brought a mastery of all the older literature on the subject, a critical judgment in analyzing the results of experimental embryology, and an extensive first-hand knowledge of abnormal embryos. He concluded "that monsters are not due to germinal and hereditary causes, but are produced from normal embryos by influences which are to be sought in their environment." They are due to causes bound up in their faulty implantation whereby alterations in the nutrition of the embryo at an early critical stage produce changes which range all the way from complete degeneration of the embryo up to a monster which survives to term.

In the new institute of embryology Dr. Mall proposed to complete the study of organogenesis and to analyze problems associated with growth which need for their solution large amounts of material and expert technical assistance.

In addition to his great contribution to the development of his science, Dr. Mall was a great teacher. He will be remembered as having trained a large group of the men who are now prominent in scientific medicine. He was one of the foremost men in the reorganization of the American Association of Anatomists, making it one of the distinguished scientific bodies in this country. He played a prominent part in the development of scientific publications in this country, being largely responsible for the establishment of the *American Journal of Anatomy*, the *Anatomical Record*, and finally the *Contributions to Embryology* published by the Carnegie Institution of Washington. He was a man of rare personality; modest, generous, original, unswervingly devoted to ideals and possessed of a genius for stimulating thought.

FLORENCE R. SABIN

A CRYSTAL MIRROR FOR FOCUSING X-RAYS

LIGHT rays may be focused either by passing them through a lens (Fig. 1) or by reflection from a concave mirror (Fig. 2). Although X-rays are known to be of the same nature as light, workers engaged in scientific research have found it impossible to focus them by the first method on account of their stubbornness in resisting refraction, or bending, in passing through ordinary matter, as light rays are bent and focused in passing through a lens. Moreover, difficulty presents itself in attempting to focus them by reflection, for the smoothest mirror that can be manufactured presents a "rough" surface to X-rays, causing them to be reflected diffusely rather than "regularly" (angle of incidence equal to angle of reflection), although presenting a "smooth" surface to light rays, and for the reason that the wave-lengths of X-rays are so very short compared with those of light.

X-rays have nevertheless been recently focused by reflection from a crystal mirror in the new Dershem X-ray concentrator.

It was found only four or five years ago that natural crystal surfaces are "smooth" enough to reflect X-rays regularly rather than diffusely. The idea occurred to Dr. Elmer Dershem, working in the physics laboratory of the University of Iowa, of making a concave mirror of crystal surfaces. Mica is the crystal that comes naturally to mind for such a purpose, as it can be readily split up into thin flexible sheets capable of bending to shape.

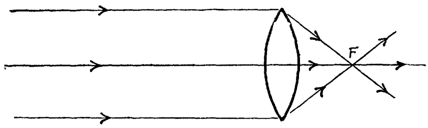


FIG. 1.

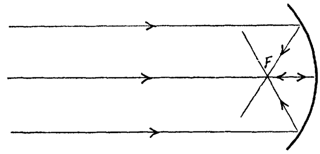


FIG. 2.

Fortunately, also, it reflects X-rays exceptionally well.

Dr. Dershem's crystal mirror, while concave, is not made in the usual form of concave mirror, but rather in the shape of an open-ended barrel, such that the source of the X-rays, which is a small spot on the surface of the target in the X-ray tube, is near one end of the "barrel" (Fig. 3). The X-rays that would otherwise pass directly through the barrel without reflection from the inside walls are screened off by sheets of lead inserted as shown. The mica barrel is so shaped that an X-ray striking on the inside walls, no matter where, is regularly reflected so that all the reflected rays pass approximately through a point, *F*, the focus.

The first X-ray concentrator was made by turning out on a lathe a wooden form of the desired barrel shape. The diameter of the form was a little over 2 inches, and the length about 4 inches. Over this form were laid the sheets of mica, that were fastened in position by gluing strips of paper over them. The whole was then immersed in melted paraffin, which, on solidifying, gave a cast. The form was then removed, leaving the hollow paraffin cast with the mica held firmly in place against its walls. A horizontal tube lying along the concentrator axis carries a pair of cross wires at either end so that the instrument can be "sighted" on the target of the X-ray tube.

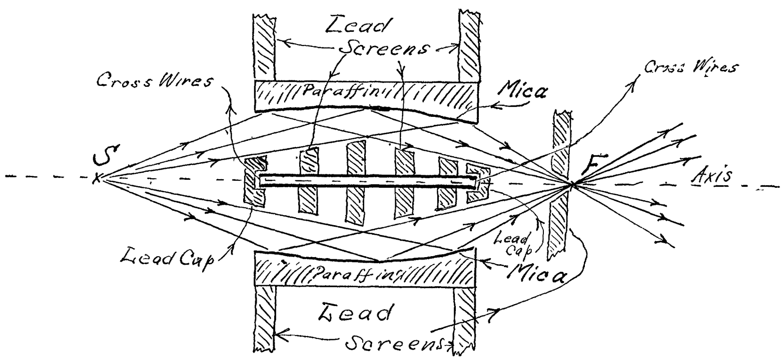
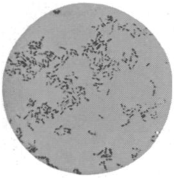


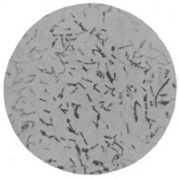
FIG. 3. CROSS-SECTION (SCHEMATIC) OF DERSHEM CONCENTRATOR.

The particular concave shape required for an X-ray focusing mirror was found by mathematical analysis. It is obtained by revolving a segment of logarithmic spiral about an axis formed of the straight line passing through the two points that are to be source and focus, respectively.

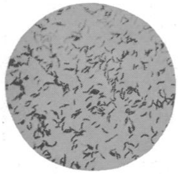
The effectiveness of this X-ray focusing mirror, or concentrator, has been demonstrated by photography of the spot focus, with the tungsten target of a Coolidge X-ray tube fur-



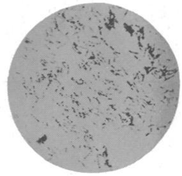
DIPHTHERIA



TYPHOID FEVER

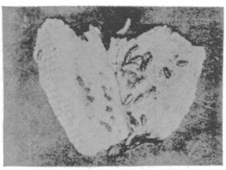


ASIATIC CHOLERA

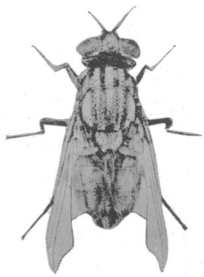


TUBERCULOSIS

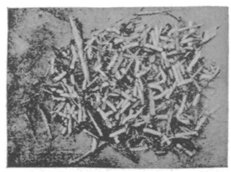
MANY diseases are known to be caused by living germs which grow in the body as mold grows in jelly. These harmless-looking germs are so small that millions might lodge on the point of a pin, and yet they cause such diseases as tuberculosis, diphtheria and typhoid fever.



LARVAE AND PUPAE OF THE FILTH FLY IN OLD PAPERS

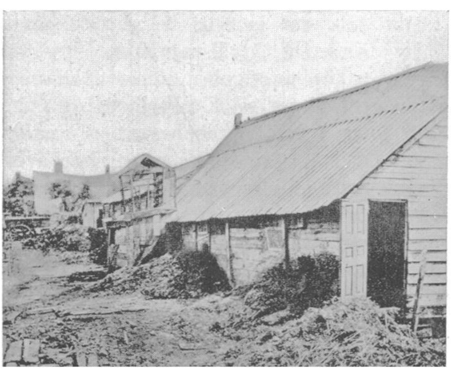


THE HOUSE FLY OR FILTH FLY.

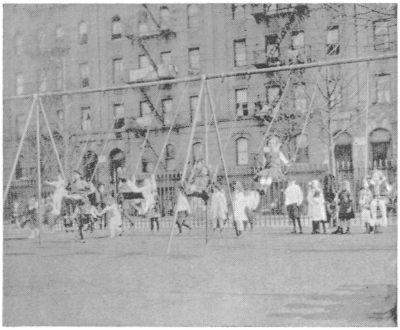


MAGGOTS (LARVAE) OF THE FILTH FLY, IN STABLE MANURE.

THE House Fly breeds in stables and garbage dumps and might better be called the Filth Fly. From these dirty places it often carries germs on its feet to food that we eat, and thus spreads disease.



MILK from dirty cow barns may carry disease germs. When kept two or three days and handled by several people before reaching the household, it may become so changed as to be poisonous, particularly to babies. Every summer, in New York City, thousands of children die from infected or decayed milk.



THE best way to keep well and to resist disease is to stay out-of-doors during the day in the fresh air and sunshine and to take part in wholesome games. Not only are these conditions conducive to good health, but also they aid the growth and development of the body and keep it strong.

nishing the source. It can also be demonstrated in a qualitative manner with light rays, as was done by Dr. Dershem some months ago at the University of Iowa.

The X-ray concentrator is of particular interest in science because it separates out a single wave-length from a beam containing many wave-lengths, and at the same time focuses it, thus giving a single wave-length with an intensity at least a thousand times greater than can be obtained by the usual reflection from plane crystal surfaces.

There are at least two possible applications that may be made with the X-ray concentrator. One is to study the effect of single wave-lengths of X-rays on the electrical resistance of selenium, since it has been shown that X-rays affect this element in the same way as light waves. The other is to test X-rays of different wave-lengths for their physiological effects, such as X-ray "burns," and the effects of "treatments" by the rays on the human body.

PUBLIC HEALTH CHARTS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE Departments of Public Health and Public Education of the American Museum of Natural History five years ago prepared under the direction three series of public health charts for the use of schools of New York City. Each consisted of a folio of wall charts illustrated from original photographs and devoted to the following subjects: "The Spread and Prevention of Communicable Disease," "Insects as Carriers of Disease," and "Bacteria and their Work in the World."

The demand for these charts in the schools was many times greater than the supply, and the Museum has now issued a new edition of the set, entitled "The Spread and Prevention of Communicable Disease" in sufficient number to supply all the schools of the city.

There are here reproduced, on a scale comparatively very small, four of the charts. The original charts are 22 x 28 inches each. Each set consists of 15 charts on heavy paper, bound at top and bottom with tin, and suited in every way for hanging on the wall. Although each chart is clearly labeled the sets are accompanied by a booklet containing information which may be of service to teachers in talks on the subject of physical well-being.

The delivery and collection of the charts is being attended to by the museum. As with the circulating collection of natural history specimens, the loan period is three weeks.

The charts may be purchased by